1.0 INTRODUCTION

The high performance TTC Processor shall be capable of providing enhanced performance in meeting signal processing requirements, like telemetry data acquisition, telecommand generation and modulation, ranging and Doppler measurements, simulation etc., to cater deep space mission requirements. The system should be highly flexible that facilitates enhancement of the functions supported and the performance of functions already supported, derived primarily from extensive use of software and FPGA firmware in both digital signal processing and data processing sub-systems and secondarily from the ability to add further hardware signal processing modules in future based on requirements. ISTRAC is already using Zodiac data system make CRT-DS lunar and Mars Missions. Under this RFP, ISTRAC, is willing to procure new latest Deep space TTC processors with latest state of the art hardware and software elements by offering few of the old CRT-DS systems as a buyback option.

The equipment should functionally adhere to all technical requirement listed below.

FUNCTIONAL DESCRIPTION

1. The TT&C Processor shall receive two orthogonally polarized (RCP & LCP) 70 MHz down converted signals and shall operate in 2 different modes.
2. In **Mode-1** the system shall pre-detection diversity combine the inputs and carry out Phase, BPSK and QPSK demodulation of the combined carrier.
3. In **Mode-2** the system shall select one of the two inputs (No combining) and carry out BPSK or QPSK demodulation.
4. In Mode-1 and in case of PCM/PSK/PM modulated signals, the unit after pre-D combining, shall carry out PSK sub-carrier demodulation, bit and frame synchronization and CCSDS decoding like Viterbi, RS, Concatenated, Turbo and Derandomization, data streams available as formatted and time tagged data on a TCP/IP (100 Base T or better) bus.
5. In Mode-1 and in case of direct PCM/PM, PCM/BPSK, PCM/QPSK modulated signals, the unit after pre-D combining, shall bit and frame synchronize the demodulated PCM signal by automatically resolving ambiguity and further carry out CCSDS decoding like Viterbi, RS, Concatenated, Turbo and Derandomization, if required, and make it available as formatted and time tagged data on a TCP/IP (100 base T or better) bus.
6. In mode-2 and in case of PCM/QPSK modulated signals, the TTCP system shall be capable of processing the data as single combined I+Q data stream, bit & frame synchronization, differential decoding, CCSDS decoding like Viterbi, RS, Concatenated, Turbo decoding, de-randomization and output data accordingly on TCP/IP bus on a single data port. In case of BPSK the system shall carry out the data demodulation as in Mode-1. The system shall take care of BPSK/QPSK ambiguity resolution automatically.
7. The system should have CCSDS standard De-randomizer, Viterbi, Reed-Solomon, Concatenated, Turbo (TCC), LDPC ½ (optional), 8-PSK/4D-TCM Decoders.
8. The TTC Processor shall, in the uplink chain, phase modulate the internally generated range tones and the telecommand video or the externally provided ISRO standard Telecommand video, either one at a time or simultaneously, on a 70 MHz &
230 MHz carrier and the 70 MHz & 230 MHz modulated output shall be provided for further up conversion.

9. The modulator shall also accept either the internally or externally generated simulation signal for modulation, in test mode.

10. The uplink module shall also consist of a CCSDS compatible Telecommand encoder for the generation of CCSDS standard command signals and the PSK sub-carrier modulator.

11. It shall house a ranging system with ESA hybrid tone and code ranging systems and CCSDS compatible PN ranging system. It shall also support enhanced with Delta-DOR functionality for direction of arrival measurement. It shall provide the Range rate information, by measuring the two-way doppler shift. The range and the range rate data shall be made available on the TCP/IP bus after formatting and accurate time tagging. Full non-destructive Doppler shall be available from all demodulators.

12. The system shall accept 5 / 10 / 100 MHz high stability and low phase noise external frequency reference to which all the signal sources of different functions will be phase locked.

13. The system shall accept IRIG-B mod code (1 KHz or 5 MHz) and 1 PPS signal for deriving time information and the time tagging accuracy shall be always better than 500 nanoseconds of UTC time.

14. The system shall also have a simulation and testing function, like BER measurement, stored file recall etc., for internal and long loop checks.

15. The system shall have local and remote monitor and control through TCP/IP (100 Base T or more) bus, which shall be embedded with station M&C system.

16. The system shall provide complete CCSDS Space Link Extension (SLE) protocol support for seamless extension of space link to users and operators on ground for cross support services and interoperability of missions. The SLE shall encompass both services and access methods and allow standardized, distributed access to satellite telecommand and telemetry services.

1.1 DETAILED SPECIFICATIONS:

I-Telemetry Processing:

A. RECEIVER:

The receiver shall perform the following functions.

1. Receives two orthogonal (Channel RCP and LCP) polarizations of IF signals at 70 MHz with independent acquisition management.

2. Anti-sideband lock facility using FFT, which can handle variety of modulation formats, including time varying multiple sub-carrier modulations.

3. Optimal Ratio Pre-detection diversity combination of channels A and B.

4. Selection of individual polarization or combined signal for demodulation.

5. PM, BPSK and QPSK demodulation of telemetry and ranging signals.

6. Full non-destructive Doppler measurement from the best, selected NCO data.

7. Time tagged AGC (individual and combined) and Eb/No data logging for signal quality analysis. Coherent AGC for remnant carrier signals.

8. Spectrum Analysis & Display and spectral data on LAN with periodic update, is desirable.

Specifications:
1. Input Frequency : 70 MHz +/- 4 MHz
2. Input bandwidth (3-dB) : 20 MHz
3. No. of IF Receivers : TWO (for RHCP & LHCP signals)
4. No. of ports per receiver : 2 (Main and alternate)
5. Isolation between inputs : > 60 dB
6. Acquisition Range : Up-to ±500 KHz Selectable (±1 MHz preferred)
8. VSWR : ≤ 1.4
9. Dynamic Range : -20 dBm to -120 dBm (carrier)
10. Noise Figure : 10 dB Max. or better
11. Noise Density : -120 dBm/Hz Max.
12. PLL Loop BW : 1000 Hz to 100 mHz selectable
    Tracking loop BW lower than acq. loop BW.
13. Carrier Lock in threshold (PM) : +8 dBHz (for 1 Hz PLL)
14. Carrier Phase stability : 0.01 rad/K
15. AGC Time Constant : 1,10,100,1000 msec. Selectable
16. AGC Type : Non-coherent before carrier acquisition,
    There-after Coherent. Should be linear for
    entire dynamic range.
17. AGC Output : Analog/ Digital
18. Anti side band : Using FFT technique, On/OFF Selectable
    Capable of locking correctly to carrier under the following signal dynamics
    and varying modulation formats, by analyzing spectral symmetry.
    i) Max. doppler : +/- 250 KHz.
    ii) Max. doppler rate : 30 KHz/s
    iii) Max. Fade Rate : 10 dB/s
    iv) Typical Modulation Formats:
        1. HK modulation up to 1.1 rad. on 32 KHz sub-carrier PSK modulated by
           PCM bit rate of 10 bps to 2000 bps.
        2. As (1) above and up to 1.0 rad. of 500 KHz pure tone modulation.
        3. Proper carrier lock to be ensured in case of direct PCM/PM also.
        4. Proper carrier lock should be ensured during uplink and sweep and
           onboard change over to coherent mode, during sweep.
19. Acquisition time (with ASB on) : < 2 sec
20. Combiner Type : Optimal ratio pre-detection combiner
    Combiner modes : CH-A, CH-B, Combined
21. Combiner Improvement : i) within 0.5 dB of theoretical, when
    Difference between channels is < 10 dB.
    ii) Best channel selected when S/N
    Difference between channels Exceed 10 dB,
    with hysteresis to avoid frequent toggling at
    cross-over point.
22. Demodulation Modes : PM, BPSK & QPSK, OQPSK, GMSK, SOQPSK,
    8-PSK/4D-TCM (R=2.0, 2.25, 2.5 & 2.75).
23. Demodulation Frequency Response : i) Sub-carrier freq. 1 to 1024 KHz
    (Both Sine & Square)
    ii) Direct PCM/PM and BPSK at 10 Msym/sec.
    QPSK having basic information rate of 10
    Mbps and 20 Msym/s (for I+Q) or 10 Msym/s
    for I & Q independent processing. Data rate
for Viterbi, RS (E=16) and concatenated coding (10 Mbps at output of decoder). Net data rate of 10 Mbps with Turbo code at output of Turbo decoder. Total 24 Mbps data rate for 8-PSK/4D-TCM (I+Q+C) modulation.

24. PM demodulation index : 2 rad. Max.
25. Suppressed carrier demodulation threshold : $E_b/N_0$ of $-5$ dB
26. Remnant Carrier demodulation (Depending on loop BW) : $E_b/N_0$ of $-9$ dB
27. Doppler Measurement (Non-destructive) : On both channels (with Hysteresis to avoid toggling)
   i) Resolution : 0.01 Hz.
   ii) Accuracy : Within 1 dB of theoretical of input $S/N_0$
   iii) Data Format : See General Conditions Point No. 2
   iv) Time tagging Resolution : 1 microsec.
28. Group Delay Stability : < 5 nsec over signal dynamic range
   < 5 nsec over 12 hours
   < 2 nsec over carrier frequency
   < 2 nsec over temperature
29. Outputs : 1. Video output (1V/rad)
   2. Digital AGC data, 8 bits. AGC for channels A, B & Combined and Eb/No - Time Tagged @ 100 Hz rate, with local logging.
30. Spectrum Display and Data : Spectral analysis and display the spectrum on the unit, with periodical Update is desirable. The spectral data may be made available on LAN for M&C purpose.

Monitor & Control:
1. Input Frequency
2. PM/BPSK/QPSK selection
3. ASB On/Off
4. Loop BW
5. Other selectable parameters

B. PSK DEMODULATOR AND BIT SYNC.

The PSK Demodulator and Bit Sync. shall perform the following functions.

1. Sub-carrier frequency selection and locking.
2. Bit rate selection
3. Simultaneous BPSK demodulation of two sub-carriers (both Sine and Square).
4. Bit synchronization (8 bit soft decision).
5. Simultaneous processing of 2 bit streams (PCM/PSK) for low rate telemetry.
6. $E_b/N_0$ Evaluation.
7. The telemetry frame shall contain the data quality bit information corresponding to the frame sync pattern errors.
Specifications:

1. Type of demodulation : PCM/BPSK
2. Code : Bi-phase (L,M,S) or NRZ (L,M,S)
3. Sub-carrier Frequency Range : 1 KHz to 1024 KHz. in 1 Hz step
4. PCM bit rate (For sub-carrier modulation) : 10 bps to 256 Kbps in 1 bit step.
5. PCM bit rate for direct demodulation : 1 K bps to 10 Mbps basic data rate. Up-to 20 Msym/s with Viterbi/ RS/ Concatenated codes. 20 Msym/s with Turbo / LDPC decoding. 8-PSK / 4D-TCM support till 24 Mbps data rate (I+Q+C).
6. No. of sub-carrier to be processed : 2, simultaneously
7. Sub-carrier loop BW : 0.01, 0.03, 0.1, 1, 3 % of bit rate
8. PCM loop BW : 0.01, 0.03, 0.1, 0.3, 1% of bit rate
9. Sync. Threshold : $E_b/N_0 \leq -9$ dB.
10. Bit sync fly-wheeling : Should be able to hold lock for data Containing 128 bits of continuous zeros or ones, with 1000 bits gap.
11. PSK demod / Bit sync/ decoder Performance : $<1$ dB of theoretical

Monitor & Control

1. Sub-carrier frequencies
2. Bit rates
3. PCM codes
4. Lock status
5. Loop BW
6. $E_b/N_0$

C FRAME SYNCHRONIZER

The frame sync. Shall perform the following functions

1. Frame locking using dedicated sync. Word by classical locking phases of Search, Check and Lock.
2. For all kinds of modulation, the frame sync should be able to lock automatically, without the need for manual re-acquisition, when the modulation is made OFF and ON in between, with the carrier being present continuously.
3. Time tagging at the start of sync. word detection.
4. Processing of 2 TM streams simultaneously.
5. Automatic BPSK/ QPSK ambiguity resolution.
6. Derandomizer (CCSDS Standard)
7. CCSDS standard RS, Viterbi, Concatenated and Turbo decoding.
8. CCSDS Packet Telemetry Processing.

Specifications:

1. Bit rate : 10 bps - 10 Mbps without coding.
Up to 20 Msym/s with RS, Viterbi, Concatenated codes. Up to 20 Msym/s with Turbo / LDPC codes. Up to 24 Ms (total) with 8-PSK / 4D-TCM (R=2.0, 2.25, 2.5 & 2.75).

2. Sync. Pattern Length : 8 to 64 bits programmable
3. Sync. Window : 1 or 3 bits
4. Sync. Word Length : 8 / 16/ 32 bits
5. Frame length : 16 to 8192 bytes.
6. Error parameters tolerance (Selectable) :
   a) Search to Check : 0 to 7
   b) Check to Lock : 1 to 8
   c) Lock to Search : 1 to 8
7. Time tagging : Corresponds to last bit of FS code
8. Data Output Format:
   a) TCP/IP (100 base T or more)
   b) To be mutually agreed
9. Data Decoding (CCSDS Standard) : 1. Derandomizer (CCSDS)
   2. Viterbi Decoding (R= ½, G=7)
   3. Reed-Solomon Decoder (223/255)
   4. Concatenated Coding
   5. Turbo Decoder (Rates ½, 1/3, 1/4 & 1/6)
   6. LDPC ½ - optional requirement
10. Data Quality Indicator : The header should contain Information on data quality like Receiver, PSK demod, Bit & Frame Sync lock status, FS error presence.

Monitor & Control:
   1. Lock Status (S,C,L)
   2. Setup parameters
   3. Quality byte indicating F.S. errors

II. Telecommand Processing

A TELECOMMAND ENCODER/ IF MODULATOR

The Telecommand Encoder/ IF Modulator shall perform the following functions.

1. Internal CCSDS compatible command encoder.
2. Provision of COP-1 software (latest applicable version for deep space probes) and CLTU level telecommand. Handles externally fed or internally generated telecommand video for modulation.
3. Phase locking to external 5 / 10 /100 MHz reference.
4. Carrier sweeping facility with programmable ranges and rates.
5. Option of automatic removal of modulation while carrier sweeping
6. PM modulation of tones and TC video (internal or external) independently or simultaneously.
7. Should accept external command video during real-time for PM modulation and external PCM and PCM/PSK (sub-carrier) signals during simulation for all specified modulations.

Tele-command Encoder Specifications:

1. Command standard : Shall comply CCSDS Standard (latest Applicable version)
2. Modulation: PCM/PSK
3. Sub-carrier frequencies: 4-50 KHz (Selectable)
4. Frequency accuracy: < ±5 in 10⁶
5. Frequency stability: < ±5 in 10⁶/Day
6. Bit rates: 4000/2ⁿ where n= 0 to 9
7. BPSK SCF: 100 Hz to 100 KHz
8. Preamble length: 0 to 2¹⁴ bits
9. Ideal pattern: 1 to 16 bits programmable

**IF Modulator:**

1. Output Frequency: 70 MHz and 230 MHz (±4 MHz settable)
2. Type of Modulation: PM (Real time)
   Other modulations for simulation
3. Sweep Range: ±1 KHz to ±500 KHz in steps of 1 KHz, single sweep positive going. Option of automatic disabling of Modulation while sweeping.
4. Sweep Rate (Linear): 100 Hz/s to 100 KHz/s in steps of 1 KHz/s.
5. Output Level: 0 to -60 dBm. Adjustable in steps of 1/0.5 dB
6. Output stability over a day/ temp. range: +/- 0.5dB
7. Output impedance: 50 ohms
8. VSWR: < 1.3
9. Phase Noise: -70 dBC/Hz at 10 Hz falling linearly to -120 dBC/Hz at 1 MHz
10. Phase stability: 0.01 rad/K (Transmit)
11. Spurious: <= 60 dBC
12. Harmonics: <= 60 dBC
13. No. of External Modulation Inputs: 1 for connecting external TC video or external simulation signal
14. Modulation Input Impedance: 50 ohms
15. Modulation Sensitivity: 0.1 rad./volt to 1 rad./volt adjustable
16. PM Modulation Index: 1.5 radians (Max) in steps of 0.1 rad. Independently adjustable for tones and TC.
17. Sense: Positive
18. Linearity: 2%
19. Group Delay Stability: < 5 ns over 12 hours
   < 5 ns over dynamic range
   < 5 ns over temperature
   < 5 ns over Doppler
20. Phase non-linearity: < 5 deg over the band

**Monitor & Control**

1. Sweep range and rate, sweep start/ stop
2. Modulation Index
3. Output level
4. External reference lock indication
5. Modulation input ON/OFF
6. Carrier on/off
7. Any other as required
III. Tracking Processor

A RANGING

The ranging shall perform the following functions.

1. ESA User Specific Tone Std., ESA hybrid tone + code and PN code ranging standard ranging formats.
2. Range tone generation and sequential transmission.
3. Ambiguity resolution
4. Range measurement & Time tagging
5. Doppler Rate Aid capability and Doppler Aid capability
6. Calibration for ground station delay and phase compensation
7. Simulation of programmable fixed delays
8. Automatic internal delay measurement & compensation

Specifications:
1. Tone Standard
   1. ESA User Tone Std.
   2. ESA Hybrid Tone & Code Std.
   3. CCSDS compatible PN Ranging.

2. i) Tone Frequencies

   ESA User Tone Ranging:
   Major Tones: 1 MHz Max. Selectable
   Minor Tones: Programmable ratios – up-to 1 Hz
   Lower virtual tones: Programmable

   ESA Hybrid Tone and Code Ranging
   Tone frequency: 100 KHz to 1 MHz Programmable
   Code Number N: up-to 24

3. Tone distortion: <1%
4. Acquisition Time duration: < 5 sec. at 50 dBHz SNDR
   <12sec for lower SNDR
5. Tone PLL BW: 1 mHz to 1 Hz Adaptable to meet dynamics and accuracy.
6. Tone Acquisition Threshold: -10 dBHz
9. Overall degradation: Within 1 dB of theoretical
10. Sampling rates: 0.1, 1 & 10 Samples/sec
11. No. of measurement samples per block: 1, 10, 100 per block selectable
12. Time tagging
   i) Resolution: 1 microsec.
   ii) Accuracy: Within 1 microsec. of time reference signal, with 1pps input
   iii) Instant of time tagging: Instant of sampling of received tone
13. Data Output: Time tagged data output on TCP/IP
14. Calibration loops & Delay entry: RF Calibration memory for up-to 4 RF paths and delays (selectable)
15. Correction for calibration: Correction memory for each of the 4 RF Calibrations
16. PN Ranging
   PN sequence supported: As per CCSDS – T4B, T2B
PN raging measurement degradation: within 0.5 dB of theory.

Monitor & Control:

1. Ranging standard
2. Sampling rate
3. Working mode
   • Standby
   • Calibration
   • Ranging
4. RF loop selection
5. Facility for entering station delay, calibration, correction and TOF
6. Other selectable parameters

IV Others:

A Time and Frequency Reference:

This unit shall perform the following functions.

1. Distribution of reference frequency to other internal units.
2. Demodulation of input time code.
3. Time distribution to other internal functions.
4. Provides time tagging information to other modules
5. Accepts 1 pps signal for ranging time tag.

Specifications:

1. Input frequency: 5 / 10 / 100 MHz.
2. Input Level: 0 dBm to ±5 dBm
3. Impedance: 50 ohms.
4. VSWR: < 1.2
5. Reference frequency output: Suitable for internal distribution.
6. Input time code: IRIG-B (1 KHz and 5 MHz), 1 PPS
7. Time code Input level: 0.5 volt to 5 volt p-p
8. Time tag capacity: 365 days, 23 hours, 59 minutes 59 seconds & 999 milliseconds.
10. Accuracy: 1 microsec.

B TM SIMULATOR

The TM Simulator shall perform the following functions.

1. Programmable sub-carrier frequency and bit rate generation.
2. PCM generation using PRN sequence or stored TM file from disk.
3. Analog PSK/PCM or PCM signal output with amplitude control.
4. Accepts external baseband simulation signal
5. BER Measurement.
6. Encoding for RS, Convolution, LDPC and Turbo coding (all rates).
Specifications:

1. Output Frequency : 70 MHz
2. Analog signal output level : 0.1 V to 2V peak in 0.1 V steps.
3. Impedance : 50 ohms
4. Sub-carrier frequencies (Sine) : 1 KHz to 1024 KHz in 1Hz step.
5. Bit rate : 100 bps to 256 Kbps in 1bps step. (For PCM/PSK/PM)
   Up to 10 Msym/s for direct PCM/PM and BPSK.
   Up to 20 Msym/s for QPSK (I+Q), Turbo
   Up to 24 Mbps for 8-PSK / 4D-TCM (I+Q+C)
6. PCM code : NRZ (L,M,S) and bi-phase (L,M,S)
7. PCM sequence type : PRN or stored frame or stored file from HDD or data over LAN
8. Modulation type : PCM/PSK on subcarrier, PCM/PM
   PCM/FM, PCM/BPSK, PCM/QPSK, 8-PSK
9. BER Measurement
   - Automatic delay adjustment between transmitted and received signal.
   - Bit to bit comparison between transmitted and received signal.
10. S/N dynamic range : 0 dB < E_b/N_0 < 14 dB
11. BER measuring range : 10^3 to 10^8 and totalizer

Monitor & Control
1. Sub-carrier frequency
2. Bit rate
3. PCM code
4. PCM sequence
5. Modulation type
6. BER

Accessories:
1. Data Logging on internal Hard disk (500 GB min.) for logging time tagged TM, Range, Doppler, digital AGC and M&C data and retrieval
2. Provision of SLE protocol for seamless extension of telemetry and telecommand services to users.
3. Display of selected de-commuted words.
4. Self test sequence for locating faults including TCP/IP Ports

GENERAL
1. Power : 230 V +- 10%, 47-53 Hz, 1 Ph.
2. Dimension : 19” Rack mountable. Max. height 8U
3. Operating Temperature : 10 - 40 deg C, Max. Humidity 95%
4. Storage Temperature : 0-50 deg C
5. Remote interface : TCP/IP (gigabit LAN / 100 Base T)
7. MTBF : To be specified. Min. 50,000 hours Preferred.
8. MTTR : < 1 Hr with spare parts available
Buy Back Option:

1. As this RFP is being processed under buy back proposal, party, in his offer, shall clearly mention the total price of their new unit, discount offered under buy back scheme and net price offered to ISTRAC after buyback of old units. ISTRAC reserves right to either opt for buyback option or buy only new systems under this RFP.

2. ISTRAC is having old CRT-DS TTC processors model CRT-DS (Ref.: SM01022200A). Their year of production is 2008. Presently all are under working condition. Presently all are under working condition.

3. Under this RFP ISTRAC wishes to exchange total 04 nos. of old CRT-DS systems against start of the art new TTCP system.

4. Old TTCP units (CRT-DS) will be returned to the party after reception of new systems at ISTRAC Bangalore.
2.0 REVIEWS

The contractor shall adhere to the following technical review requirements that are necessary for total understanding and successful execution of the project.

2.1 Progress Review (PR)

The vendor shall perform a design effort culminating in a formal progress review (PR). This review shall address the high level design of the system, mapping the system requirements to a System Description Document (SDD). The SDD shall be delivered at least two weeks before PR. The venue of PDR shall be ISTRAC, Bangalore / Video conference.

The SDD shall, at a minimum include

- System Overview
- General architecture with proposed hardware and software modules.
- Design considerations and design details of major modules.
- Performance analysis of major requirements and specifications.
- Mechanical, Environmental and thermal design aspects.
- List of deliverables both hardware and software and documents.
- Preliminary analysis of reliability, availability, Maintainability etc.

The following contract deliverables shall be delivered at PR.

- System Description Document (2 copies)
- Preliminary System Installation and Commissioning plan.
- Software development plan & ICD.
- Preliminary Quality Assurance Plan.
- Preliminary Acceptance Test Plan.
- Project Management and Schedule Plan, including major milestones.

2.1.1 Technical Interface Meeting (TIM):

The vendor in his own interest is free to organize Technical Interface Meetings with ISTRAC, at a mutually agreed venue or via audio / video conference, with ISTRAC for exchange of information and review of progress. ISTRAC expects at-least one TIM during product realization phase.

These meetings could also be held as informal design reviews and shall serve the purpose the regular monitoring of the progress / address any issues associated with realization of the total system. The vendor is responsible for designating the subject. Date & mode of such meetings with mutual consent and assure availability of concerned personnel.

3.0 PROJECT MANAGEMENT

The contractor shall perform all the project management functions including technical and business management functions that are necessary to execute the total effort required by this contract.
The contractor shall develop and implement a Management Program that clearly defines how the complete project will be managed and controlled. A task matrix keyed to the Work Breakdown Structure (WBS) shall be developed in sufficient detail to identify contractor and sub-contractor responsibilities.

The vendor shall establish and implement a project management office function to manage all technical performance requirements, including quality, reliability, maintainability, schedule and delivery requirements of the contract. The contractor shall designate a Contract Project Manager (CPM) to coordinate day-to-day activities and to act as technical interface with the Contract Technical Administrator (CTA) to be identified by ISTRAC. The CPM shall be directly responsible to coordinate and manage the following tasks.

- Progress Review
- Technical Interface Meetings

3.1 Scheduling and Coordination

The contractor shall establish, maintain and control a detailed schedule that shows the order in which the works will take place, including identification of major events and milestones and shall cover the period from award of contract till the end of warranty period. The delivery schedule committed by the party shall be strictly followed and any delay in delivery would attract LD clause.

3.2 Quality Assurance

The vendor shall be ISO 9001 certified for Quality Management and Quality Assurance. The vendor shall establish and conduct a Quality Assurance Plan (QAP) as a part of this contract. The plan shall be implemented at award of contract and continued throughout the life of the contract. The plan shall consist of sequential inspections and progressive Quality Control throughout the developmental and installation cycle. The plan shall detail methods for documenting defects, identifying deficient areas, providing timely correction of deficiencies and recommending solutions to systemic problems. The plan shall assure that the quality of all items supplied and the services provided to ISTRAC, meets the specification requirements and objectives, whether manufactured or processed by the contractor or procured from sub-contractors or vendors.

The personnel assigned to quality assurance functions of QAP shall be fully trained in their areas of responsibility and shall have sufficient and well-defined responsibilities, independent authority and organizational freedom to identify and evaluate quality programs and to initiate and recommend timely and positive solutions.

Documentations which demonstrates, that the contractor has accomplished Quality Assurance inspection shall be maintained and be made available to ISTRAC prior to presentation for preliminary acceptance. The inspection and test documentation shall clearly describe the test or inspection to be carried out with acceptance and rejection criteria and shall list the quantity and type of deficiencies found and the nature of corrective action taken.

The QAP shall address the certification, calibration and maintenance of test and measuring equipments, which will be used or installed to assure the standards established
in the required tests or inspections. The QAP shall establish and maintain an effective and positive control of non-conforming supplies or products including procedures.

4.0 Factory Acceptance Tests

Factory Acceptance Tests shall be performed by the vendor on major functional and performance parameters of the product that includes hardware and software elements. The supplier shall provide the types of tests to be carried out & the test procedures for carrying out the Factory Acceptance Tests well in advance, for the approval & mutual agreement. The tests results shall be submitted to ISTRAC for approval, before the actual shipment of the equipment.

ISTRAC will have the option of witnessing the tests at the vendor’s or sub-vendor’s/ vendor’s premises. The place of performance of these tests may be mutually decided. Any cost implications towards shall be clearly indicated in party’s offer.

5.0 SUSTAINING ENGINEERING

5.1 Hardware Maintenance

For the system supplied, minimum three years standard warranty is expected. The vendor shall be responsible for hardware maintenance of all equipments and systems procured through this contract till the end of warranty period. The vendor shall also provide offer for extended warranty for further 2 years to have total five years of warranty for the systems offered. The warranty period shall start after system acceptance by ISTRAC at ISTRAC premises. The vendor shall be responsible for imparting necessary training required for maintenance of all the equipments whether manufactured by the vendor or procured thru a sub-vendor.

The vendor shall provide a list of recommended spares modules and supply those spares and spare equipment as detailed in any resulting contract. The vendor shall guarantee supply of spares for a period of minimum of 10 years. The vendor shall provide the System User’s Manual and operation and maintenance manuals of all the systems covered under this contract.

5.2 Software Maintenance

The vendor shall retain full responsibility for the software maintenance till the end of warranty period. The software maintenance effort includes corrective changes/ upgrades to the software configuration. Documentation updates shall be made to reflect any changes made in the System User’s Manual and Software Maintenance Manual.

6.0 DOCUMENTATION

The vendor shall also deliver all the technical documentation, which explains the theory of operation, system description, system integration, interface control, installation, and maintenance etc., required for the user. The system level documentation, namely System Description, Integration and Interface Control documents shall be made available before provisional acceptance of the system.

The documentation at sub-system level shall contain User Manual, ICD, Installation Manual and Maintenance Manual and shall be made available before provisional
acceptance of the system. These documents shall be supplied in both hard copy and soft copy form.

General Conditions:

1. This is a Two-Part Tender and the party is required to submit the Technical proposal and the Commercial offers in **TWO separate sealed covers**, clearly written so on the top of the covers. No commercial/ price details shall be provided in the technical offer and failure to comply with this requirement may result in rejection of the bid from the vendor.

2. The bidder shall provide complete technical details of the offer with detailed explanation of the function of the system, the various options available and any other information that may be required to evaluate the offer.

3. The bidder shall bring out point-by-point technical compliance matrix against all the specifications and functional requirements. The bidder shall explicitly bring out all the points in the remark column wherever the specifications are not met or exceeded.

4. If any software / hardware license is required to realize the said unit, the party shall obtain the same. In case of any inputs required from ISTRAC to obtain license, it will be provided to the party by ISTRAC.

5. The bidder may obtain required clarifications, if any, before presenting the bid.

6. The bidder shall bring out all the optional features of the offer and shall accordingly quote the price for each of the options separately.

7. The system shall be considered to be accepted by ISRO only after the successful completion of the on-site acceptance tests (performed at Bangalore) duly certified by ISRO. Party or its local representative shall able to provide technical support at ISTRAC premises towards acceptance testing of the supplied unit.

8. At the time of installation and commissioning of the system if it is found that some additional hardware accessories or software items with licenses are required to complete the configuration to meet the total system requirement of the configuration which were not included in the vendor’s original list of deliverables then vendor is required to supply such items to ensure the completeness of the configuration at no extra cost.

9. The product offered shall be based on a proven design which is already been demonstrated in the field and not on any new development which is yet to be qualified. The bidder shall provide the list of customers, to whom similar systems have been supplied earlier by them and performance certificates from the concerned, if any.

10. The party should be able to arrange for a demonstration of the equipment, if required by ISTRAC, during the evaluation process.

11. The bidder shall guarantee supply of spares and maintenance support for at least 10 years from the date of acceptance of the system.

12. The bidder shall indicate other terms conditions like, validity, payment terms, freight, duties, export licensing requirement etc., clearly in their technical bid. No price/cost details to be indicated in the Technical Bid.